# Everyday creativity in design process

This is a pre-print copy of the published paper:

Lloyd, P., & Jones, D. (2013). Everyday creativity in design process. *Art, Design & Communication in Higher Education*, *12*(2), 245–261. doi:10.1386/adch.12.2.245_1

Available at :
www.ingentaconnect.com/content/intellect/adche/2013/00000012/00000002/art00008

# Everyday creativity in design process

Peter Lloyd, University of Brighton[1]

Derek Jones, The Open University[2]

## Abstract

The study of creativity in design has tended to emphasize its value and location in the individual designer as part of a statistically outlying population rather than as a normal characteristic of an entire population. Theories of creativity have generally stressed either its mysterious, gift-like qualities to an individual or as a constructed relationship between consumer and designer. This article, in developing a third view of creativity in design as a 'normal' phenomenon, describes a study of 1038 student design assignments obtained from a distance-learning course in Design Thinking. The article shows how normal distributions of design outputs can result from a large population following a structured design process. We argue that the creativity displayed is a natural result of the 'grammar' of that process. Seen in this way creativity becomes less of an individual 'gift' to a select minority, as generally understood, but an everyday occurrence to problems of design.

## Keywords

assessment of creativity, creativity, design, design education, design process, grammars of creation, originality

[1] School of Art, Design and Media, University of Brighton, 6 Dorset Place, Brighton, BN2 1ST, UK. E-mail: p.a.lloyd@brighton.ac.uk

[2] Faculty of Maths, Computing and Technology, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK. E-mail: derek.jones@open.ac.uk

## Views of creativity

The study of creativity has tended to emphasize its value, scarcity and location in the individual rather than its everyday occurrence in either a social or a cultural context. The idea of the 'creative genius', central to Enlightenment thinking, treated creativity as a special 'gift', a view that was reinforced during the romantic movement in Europe, where the creative individual was valued highly in society. This was especially so in the creative arts, where key moments of insight and outstanding technique were considered to have an element of magic, mystery or divine intervention about them (Osche 1990). However, recent work has revealed more methodical and mechanical approaches to what were once considered acts of romantic brilliance. D. Hockney (2006), for example, has shown how the use of optics to render accurate subject proportions helped artists in their work and explains acts of painting that were previously considered as pure genius.

### Individual creativity

In early twentieth-century discourse, where approaches to creativity became more systematic and rigorous, the early traditions of psychoanalytic, cognitive, behaviourist and humanist work still focused on individuals or individual characteristics (Ryhammar and Brolin 1999). H. Poincare's (1910) four-stage model of creativity – preparation, incubation, illumination and verification – reinforced this idea, with individuals operating in many different fields readily using it to account for, and to describe, their own working practices (and perhaps tacitly propagating the idea of their own genius through the idea of sudden illumination – a view recently criticized by A. Robinson (2010)). In the latter half of the twentieth-century significant studies (Mackinnon 1965; Sternberg and Lubart 1991) have generally continued to focus on individuals in explaining the nature, development and origin of creativity. D. W. Mackinnon (1965), for example, correlated personality characteristics with creative outputs in showing that architects assessed as more creative were also statistical outliers on dimensions of, for example, mental health. This 'statistical' view of creativity, as an outlying sub-group of the general population, continues to be presented as a narrative of individual success in the popular science literature (Gladwell 2009) and research in design creativity often orients itself around the thought processes of individual designers (e.g. Dorst and Cross 2001; Casakin 2007; Lloyd and Scott 1994).

### Creativity constructed

There are, however, alternative views of creativity that place emphasis on it being a more complex cultural phenomenon, something that is constructed through social relationships, rather than being located in the individual (e.g. Amabile 1983; Cziksentmihalyi 1998; Ryhammar and Brolin 1999). The most advanced yet acceptable (MAYA) principle of Raymond Loewy (1951) is an early example of this in design, where a value judgement about a particular design output is determined through a kind of negotiation between designer and consumer, a

point discussed at length in A. Forty (1986: 239–45). More recently work looking at novelty and originality on the one hand (Hekkert et al. 2003; Hsiao and Chen 2006; Hung and Chen 2012), and the relationship between designer and consumer on the other (Sellier and Dahl 2011; Crilly et al. 2004), can be understood as part of this 'constructed' view of creativity in design. Such research de-emphasizes the primacy of the creative designer, and hence of the 'individual' view of creativity, in stressing the underlying exchange that occurs around creative outputs; yet the idea of the gifted creative individual still exists in such a view. A market, to some extent, depends on there being unique, special and individual things and by extension the people who create those things are doing something unique and special. Creativity, the underlying engine that produces those things, is still being conceptualized as a gift bestowed, although this time by the market, not as divine inspiration.

## Grammars of creative production

A third view is to extend the social construction view of creativity a little further and to consider creativity as commonplace (Coyne 1997), a function of everyday experience. This view posits creativity as the diversity of results that are produced from a single population following an 'agreed' grammar of creation (Steiner 2002). The most obvious example of this is that of transformational grammar in the use of language, something that almost all of us share as humans. Noam Chomsky's famous 'nonsense but grammatical' sentence 'colourless green ideas sleep furiously' (2002) illustrates how we can be effortlessly creative if an appropriate grammar of production and understanding exists. We continually generate and parse sentences we have never said or heard before, almost without thinking about it, because we share and understand the underlying grammar (if not always the particular language). In a similar way other work describes a series of methods (or grammars) by which creativity, independent of individual, can find expression in complex problem solving (de Bono 1977; O'Hara and Sternberg 2001). A grammar of thinking enables a diverse population to produce a diverse range of creative outputs.

Coincidentally, extending a social view of creativity into something like language refocuses our attention on the individual, albeit considered collectively. What is now the case, however, is that, rather than considering the creativity of individuals as part of an elite group of a larger population – as outliers – we are now considering the creativity of the larger population as a group of individuals – including the outliers. What we are talking about, in both the first and third views, is populations and abilities, not relationships and contexts.

## Views of creativity considered

Our aim, in drawing out the three positions above, is not to discount any of the views, as there is clearly evidence to support all three, and in any case they do not appear to necessarily conflict with one another. Certain individuals clearly have more aptitude and talent for creative work than others and the products of

that work are generally held to be valuable in the marketplace. What we are trying to lessen is the sharp distinction between creative people and non-creative people that the individual view tends to reinforce. We have attempted to do this by laying out two alternative views of creativity that, in different ways, diminish the primacy of the creative designer. This matters because how we teach and understand creative subjects like design depend on definitions of creativity that often remain implicit and the individual view of design is still strongly embedded in many design programmes across the world as the only view of creativity (Craft 2006).

What we are attempting to do is to present a counter-balance to this view, not to discredit it, but to properly position it with respect to other, equally convincing and effective, ways of understanding creativity (in design). This might seem, in some ways, to be a contradictory exercise; it might be argued that the project of design education is, in essence, to develop individual creativity. We would agree with this assessment but point out that the development of individual creativity does not necessarily entail that creativity is an individual act. We note that the tension and difficulties in mediating individual creativity whilst still recognizing the influence of social, cultural and commonplace notions of creativity is a considerable challenge, but we think that it is well worth undertaking in order both to develop teaching that is more appropriate to the modern inter-disciplinary and socially mediated world but also to reflect broad contemporary practice in creativity for design and design thinking in particular.

In the rest of the article we present empirical evidence to develop and nuance the third view of creativity outlined above. Through using a grammar of creation in combination with distance education in Design Thinking we have been able to explore how we might understand creativity for design in a normal population.

## Context: A ‘Normal’ population

The 2010 launch of a new distance-learning course in Design Thinking at The Open University in the United Kingdom in 2010 provided us with an opportunity for a large-scale study of creativity in relation to design. Full details of the course are described elsewhere (Lloyd 2013; Jones and Lloyd 2013) but U101: Design Thinking: Creativity for the 21st Century was essentially the first half-year of study in a three-year Design and Innovation bachelor’s degree qualification. The model of distance learning adopted by The Open University allows a much larger cohort than studio-based teaching. Currently about 1000 students study U101 every year and to date nearly 4000 students have taken the course, a considerable number.

The Open University has a unique demographic among universities, being a provider of distance learning. Students of all ages study with the Open University, with a particularly high proportion of mature students; almost all students study part-time and many work in full-time jobs across a wide range of professions. Furthermore, as the university does not require any previous level of qualification,

students generally have little experience of study in creative disciplines and often low levels of confidence. This contrasts greatly with most conventional universities (and most universities where studies in creativity are carried out with students as participants) where first-year design students often have existing creative qualifications, tend to come from a similar age group and have shared values and backgrounds.

To some degree, then, the population of first-year Open University students might be considered more ‘normal’ than a first-year cohort in a conventional university, certainly in providing a broader cross-section of UK society. In statistical terms we are looking at a representative sample of a general population rather than an outlying population of a very specific population. The fifyeen defined regions making up the United Kingdom in which the Open University teaches students all have different demographics and this is reflected in any one course population. For example, the London region has a large proportion of immigrant and ethnic communities and this is reflected in the London-based student demographic in contrast with, say, the South West region. With students based in all regions of the United Kingdom studying Design Thinking, the argument for considering them a representative sample of the population at large is strong.

Having a large (certainly in the terms of design education) representative sample of the UK population has provided us with a unique opportunity to develop the third view of creativity outlined above – as a grammar of production – in determining what ‘normal’ or commonplace creativity might look like. The fact that students have to submit their work online, to the same format, presents an opportunity for a large-scale comparative analysis of the work they have produced.

This article presents results from an exploration of data on the first design assignment for the course and, for many students, their first ever design assignment: to design a T-shirt. In the rest of the article we first describe the ‘participants’ in the study, 1038 students whose T-shirts were looked at. We then describe the design task and lay out our method of analysis, before presenting the results in a number of bar graphs that show population distributions. Our central question has been to find out what normal creativity might look like, in terms of visualization and conceptualization, across a large population of people.

# Method

## Participants

Students from three presentations of the first-level Design Thinking course (U101) were treated as participants in this study. 314 students completed the course in 2010, 493 in 2011 and 272 in 2012, making a total of 1079 students who submitted a T-shirt for their first design exercise.

Across all courses, 47% of these students were females and 53% were males. The average age was 30–39 years, with an age range from 16 to over 65 years. 12% of students had a registered disability. A proportion of students had experienced some kind of creative education, some in higher education, although the majority had not. The vast majority of students studied the course part-time. For 40% of the students, U101 was their first Open University course (new students), while 60% had previously studied other courses at the Open University (continuing students).

## Task

Students studying U101 receive a creative welcome pack in the post, containing (amongst other things) a white T-shirt and a sheet of A4 T-shirt transfer paper – see P. Lloyd (2013) for further details. These are used for their first design assignment of the course, completed over a three-week period and five weeks after the start of the course. The three-week assignment follows a prescribed design process (shown in Figure 1) with an exploration phase, a concept phase, a detail or proposal phase and an evaluation phase. Students record their activity – in photos and text – for each phase, and add them to the 'nodes' of Figure 1 using the specially created software environment CompendiumDS (Jones 2014). Each completed assignment, then, forms a 'map' of the design process. In the terms we have discussed earlier this is the grammar of the design process, the sequence of connected activities through which individual students 'speak' their designs.

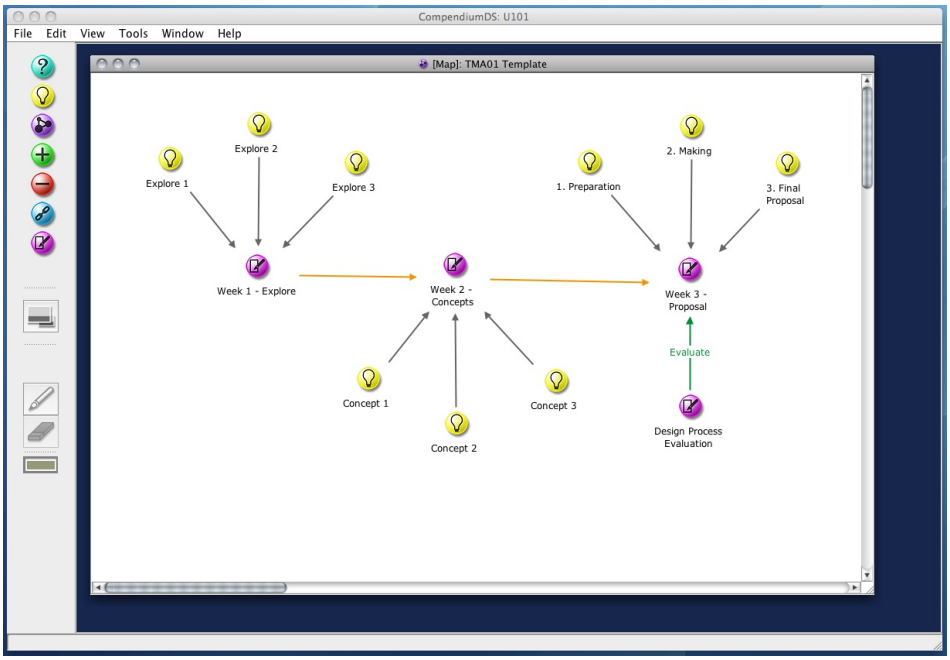


Figure 1. The design process template for the T-shirt design task. Students record their activity with images and text and add these to the nodes of the figure during four phases of design: exploration, concepts, details, and evaluation. Each phase consists of three activities.

The overall task in creating a T-shirt is to use the hand as an inspiration, together with tracing around photos as a method of drawing. For the exploration phase students are asked to consider following three parts: (1) a particular aspect of their hand, (2) a story about their hand that might involve a particular object and (3) a gesture that they make with their hands. For each aspect they are asked to take a photo. Figure 2 shows an example photo that students are shown for part (1) of this phase.

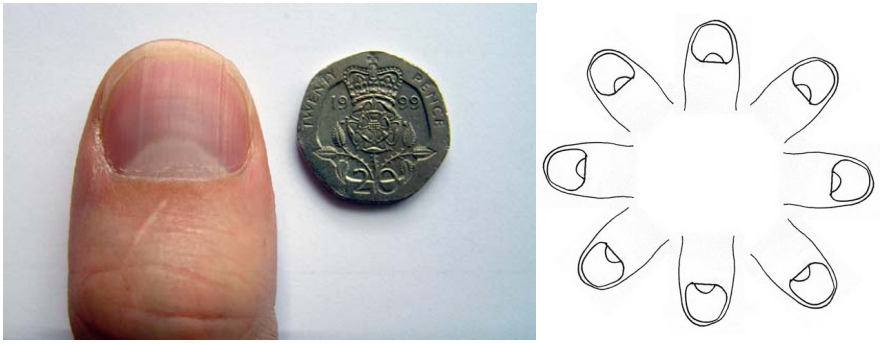

Figure 2. Example images for the 'observation' concept source: a photo of a thumb (left), and pattern derived from tracing the image (right).

In the concept phase students are asked to take each of the photos they produced in the exploration phase, trace round them on paper and then develop each one in simple ways – with: pattern, colour and text. Figure 2 shows an example that students are shown for 'pattern' of this second concept phase.

In the detail phase, where the students make their design proposal, they are directed to choose their favoured concept and develop it further before they print it onto the T-shirt transfer paper and transfer it to their T-shirt. One of the ways in which further development is suggested, if students are having trouble choosing, is by combining concepts from the second phase of their design process. Once printed, the students transfer their design onto their T-shirt with a hot iron and then complete a final design process evaluation.

Once all phases are completed and images and descriptions of their design activity added to the nodes of Figure 1, students then submit their 'maps' for assessment. The assignment is assessed on the quality of their design process, not on the quality of their T-shirt outcome. During their design process students use an online design studio and portfolio (Lloyd 2013), and when they have finished their T-shirt assignment they upload a photo of their final outcome into their portfolio. This photo is available for all other students (and tutors) to view once it has been uploaded, which is not necessarily after the cut-off date for the assignment. This means that students are able to provide inspiration for one another, although in terms of the analysis it also means that T-shirts could not necessarily be considered independent from one another.

## Analysis

The analysis centred wholly on the T-shirt outcomes that were produced from the design task. In thinking about how to analyse these we decided on two types of criteria: objective criteria related to both the task and the classification of the T-shirts and subjective criteria related to the quality of the T-shirts. This provided us with data reflecting the nature of the process followed, the output produced and the consumption of that output, thus combining elements of the three types of creativity described earlier in the article.

For the main objective criteria we classified T-shirts by:

- Concept source (observation, story/object, gesture, unknown) – i.e. the three concept nodes in Figure 1
- Centre placement (yes, no)
- Multiple transfers (yes, no)
- Use of text (yes, no)
- T-shirts were further broken down into the 'concept source' categories of 'gesture' and 'story/object':
- Type of gesture
- Type of object

Figure 3 shows examples of T-shirts from the four concept source categories. Figure 4 shows examples of all eight yes/no combinations of centre placement/multiple transfers/use of text.

Figure 3. Example T-shirts showing concept sources: observation (top left), gesture (top right), story/object (bottom left), unknown (bottom right).


Figure 4. Example T-shirts illustrating every combination of centre placement (Y/N), multiple transfers (Y/N), and T-shirts containing text (Y/N). Clockwise from top left: NYN, NNN, NYY, YNY, YNN, NNY, YYY, and YYN.

For the subjective criteria we classified T-shirts on one quality dimension:

- Would you purchase the T-shirt? (potentially, maybe, probably would not)

An initial selection of 25 T-shirts was collated to pilot the classification criteria with two raters (the authors) and to discuss their relevance in the light of example T-shirts. Good agreement was obtained for the concept source category, although some development of definition was required.

A pre-selection menu of ten popular gestures was made for the gesture sub-category, with an 'other gesture' option provided along with a further gesture description field for raters to add gestures to. No pre-selection menu was set for the story/object sub-category, but a description field was provided.

Excellent agreement was obtained for the 'centre placement', 'multiple transfers' and 'use of text' criteria; so these were unchanged. There was some disagreement in the subjective criteria of quality. This was as expected, due to differences in taste, but the category wording was amended to provide a subtler gradation in quality rating. From the pilot, three categories were considered to be a sufficient discriminator of both the quality of T-shirts and rater taste.

A total of 1038 T-shirts were classified, 500 by rater 1 and 636 by rater 2. This meant that 102 T-shirts were classified by both raters, providing further data on rater agreement. Both raters had, over the three years of the course, some familiarity with a small proportion of the T-shirts, but this was not considered to present significant problems to rater objectivity.

## Results

Our intention, in presenting the results, is to present them as a normal (bell curve) distribution, hence making the argument for the creativity that is displayed, as a result of following the grammar of the design process, as being 'normal'. Figures 6, 7, 8 and 10, especially, are presented in this way. As we were not using continuous data in our study we make no statistical claims in our results, our point being that the choice to present distributions of discrete data in a certain way can be, to some extent, an arbitrary one. The distributions that we show, then, are, to some degree, rhetorical.

### Rating agreement

Table 1 shows the level of agreement obtained between the raters for the 102 T-shirts that were rated by each rater.

Table 1. Rating agreement for T-shirt rating criteria.

| Rating Criteria | Level of Agreement |
|---|---|
| Concept source | 73.5% |
| Centre placement | 89.2% |
| Multiple transfers | 96.1% |
| Text | 92.2% |
| Quality | 44.1% |

The criteria of concept source had slightly less agreement than was expected. On further analysis there was a 17.7% difference in interpretation (where raters could agree to either rating category) and 8.8% attributable to either genuine disagreement or a category error. The lowest agreement was about quality, at 44.1%, which was in line with expectations and the results from the pilot study. Three 'potential purchases' were agreed upon and these are shown in Figure 5.


Figure 5. The three T-shirts out of a sample of 102 where both raters agreed with the judgement 'potential purchase'.

## T-shirt classification

Figure 6 shows the distribution of T-shirts by concept source. The expectation had been for a relatively even distribution between concept sources, but Figure 6 clearly shows just over half the T-shirts deriving from the 'gesture' category. The potential fixation effect of showing images relating to the 'observation' category (Figure 2) appears not to have resulted in a choice for that concept source.

The choice of gesture might be due to apparent simplicity – especially in photographing and tracing – but it is not obviously easier than other concept sources. One possible explanation might be to do with a possible learning effect whereby students improve their understanding of what is required through their

first two explorations. Their third exploration might, then, naturally be perceived as the best one.

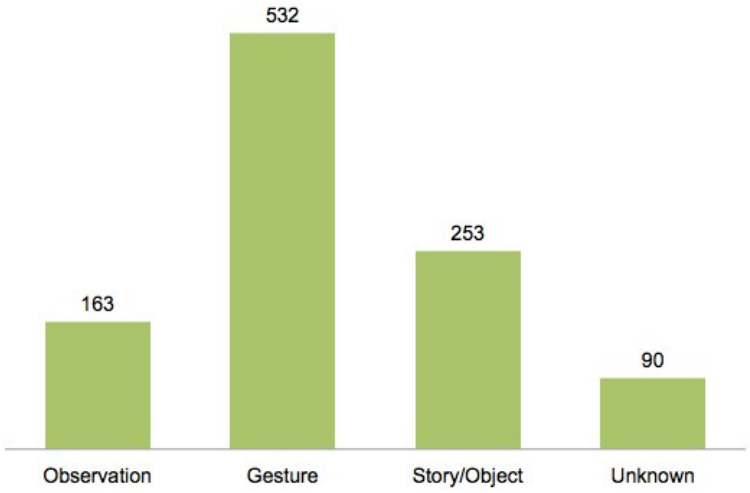


Figure 6. Distribution of T-shirts by concept source

The ‘type of gesture’ sub-category is broken down in Figure 7, for all 532 T-shirts choosing gesture as a concept source, and where the gesture count was greater than 4. The expectation was that ‘thumbs up’ and ‘ok’ gestures would be most popular, but the range of gestures (88 in all) was a surprise. Gestures that we had pre-selected for categorization did prove among the most popular although gestures figuring in the ‘other gesture’ category, notably a heart and animal shape made with the hands, were equally as popular.

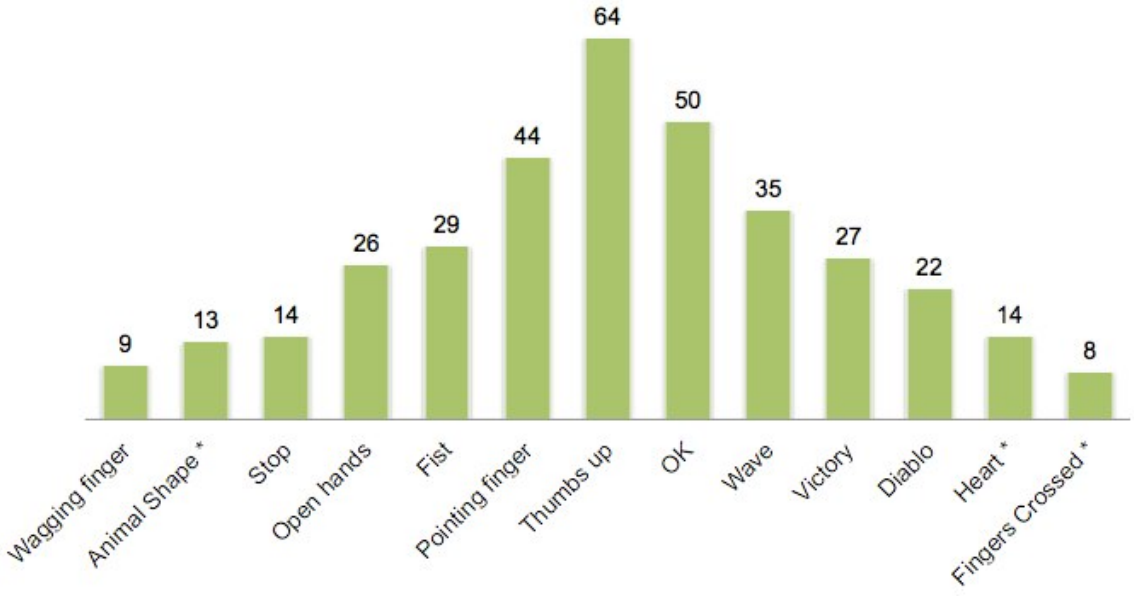


Figure 7. Breakdown of different gestures in the ‘gesture’ concept source.
*denotes gestures that were not in the original pre-selection for raters.

The second most popular concept source was story/object and the most popular objects, scoring a count of more than three, that were used in the T-shirt designs are broken down in Figure 8. We had expected that pens and pencils would figure prominently, but we had not expected that the guitar would be quite so popular. Figure 8 indicates that object examples were proportionally less popular than gestures (i.e. the most popular gesture was just over three times as popular as the most popular object) and the range of objects depicted was much wider (132 in total). What was a surprise was how natural and obvious objects seemed once they were seen, although being difficult to predict in advance.

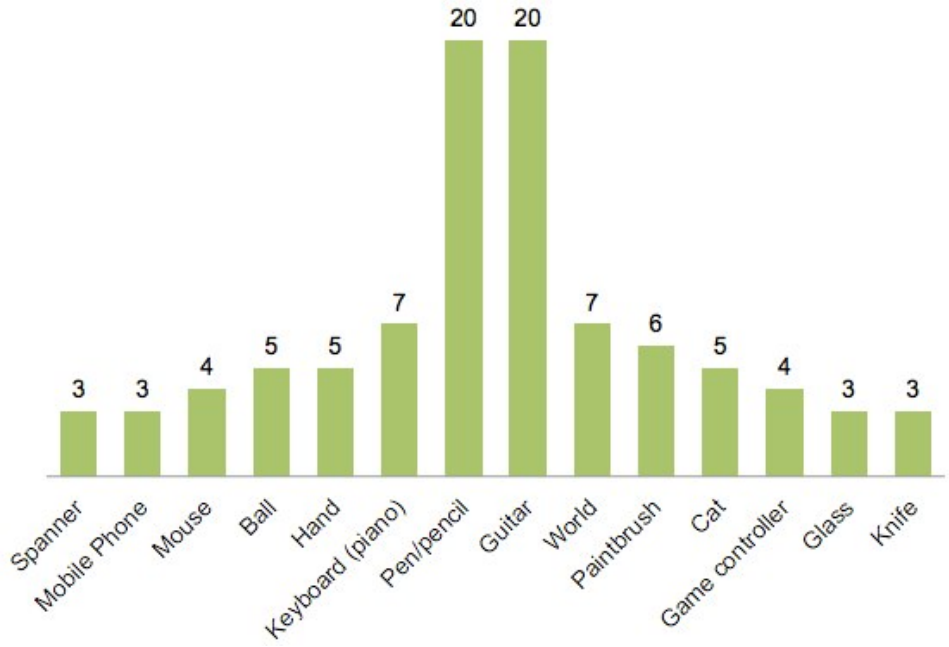


Figure 8. Most popular objects for the story/object concept source.

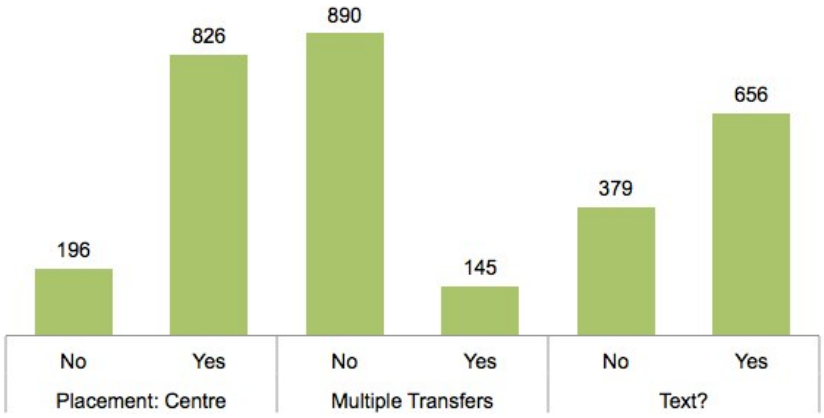


Figure 9. Distribution of T-shirts by centre placing (left), multiple transfers (middle), and T-shirts containing text (right).

Figure 9 shows the raw distribution for the ‘centre placing’, ‘multiple transfers’ and ‘use of text’ criteria, with Figure 10 showing the distribution of all combinations of these criteria.

Our assumption was that centre placement and one transfer would be the norm, with a preference for the use of text, and this was borne out in the data (the YNY category). One central motif on a T-shirt with or without text is by far the most popular means of presentation for T-shirts on the market; thus, it was no surprise to see student T-shirts reflecting this. What is perhaps surprising is that 24 per cent of T-shirts, one in four, deviated from this norm. It may be possible that students, too, realize this and deliberately choose solutions that obviously express this deviation, believing that ‘different is creative’.

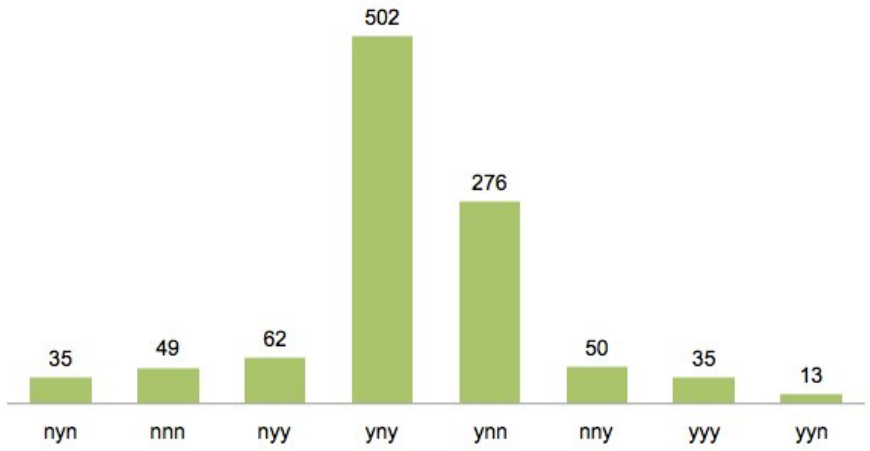


Figure 10. Percentage distributions of all combinations of centre placement, multiple transfers, and T-shirts containing text.

Finally, Figure 11 shows how the two raters compared in their judgements about whether or not T-shirts were potential purchases. Overall, rater 2 tended to like more T-shirts than rater 1, categorizing 58% in the ‘potential purchase’ and ‘maybe’ categories against rater 1’s 38%. Both raters recorded similar levels of ‘potential purchase’ judgements, however, 12% for rater 1 and 16% for rater 2, roughly one T-shirt in seven for both raters. This might indicate some kind of tacit expectation on the part of raters that achieving a certain threshold quality should be uncommon, but not rare. The proportion of one T-shirt in seven appears appropriate in that respect.

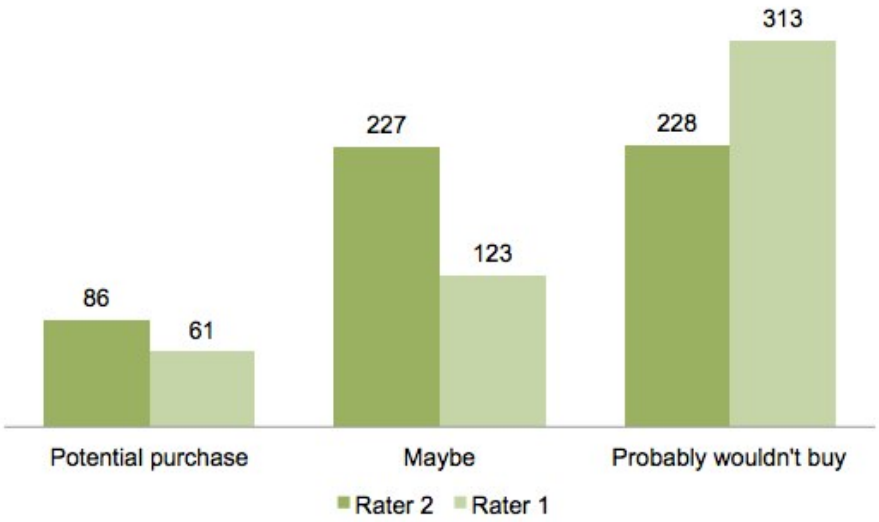


Figure 11. Judgements about T-shirt quality by rater.

## Discussion

We started the article by framing three views of creativity. The first view considered creativity as something of an innate talent or gift, located in the individual. The second view considered creativity as a constructed relation between creator and consumer, as something that is negotiated through exchange, rather than a self-evident truth. The third view considered creativity as something altogether more commonplace, as the diversity of outputs produced by following a process grammar.

Which view do the results we have presented best fit? Figure 11 reveals that there are differences in the quality level that students achieve that would indicate varying levels of ability and the possibility that some students have more of a 'gift' than others. However, the overall proportion of judgements for high-quality T-shirts (14 per cent) appears significantly higher than the individual gift theory might imply for geniuses or outliers. Indeed judgements of high-quality T-shirts were made right across the distributions of Figures 6, 7, 8 and 10, implying that it was not necessarily prima apparent uniqueness or originality that led to judgements of high quality. The T-shirt form in itself is interesting to consider here, in the sense that it acts as a form of expression; thus, a design that might appear rough, naïve or even obvious can be highly valued.

Where this leads the discussion in terms of styles and types of consumption, however, naturally takes us to the second view of creativity, as a construction between (in the study) the students and the raters. The variable quality of the T-shirts produced provides some evidence for this view. Both raters had an idea of what they were judging T-shirts on, in considering whether they were potential purchases or not. They could also make a convincing attempt, using aesthetic categories, to explain why certain T-shirts were more valued than others (given

effects of ordering, viewing the T-shirts as images and general consistency of considering hundreds of T-shirts). But the constructed view still depends on some implicit definition of creativity, even if that now resides in the consumer (rater) rather than the producer. What it does not do is really account for the full range of our data.

The third view of creativity, as the normal result of following a defined grammar, provides the fullest account of the data. Presenting the results in the shape of normal distributions illustrates both how wide the creative response was to the problem but also, in some respects, how narrow, with many students choosing similar subjects and configurations. Having a scheme of objective classification for the T-shirts helps to show the full extent of what was produced; thus, what the variable judgements of quality then indicate is that, although some people are able to 'speak' well with the grammar and some less well, almost all are able to say something that can be understood as being creative. Creativity, in this view, is not about being creative or not, or constructing creative, but simply thinking of every response as creative. The design task we have described in this article had a predefined 'grammar' to it, a prescriptive process that students could not help responding to creatively. In this sense creativity is the natural outcome of committing to a defined process, and crucially the course provides the necessary framework for that commitment.

Many comments by tutors and students alike showed surprise at how much creativity can be generated from such a simple exercise. By providing a clear, activity-based design process, students are able to 'trust' the process but at the same time diverge in their thinking. Before this assessment, students consistently raised concerns about their creative and artistic abilities or lack of imagination. At the end of the activity they were beginning to realize that it is the act of committing to the process that really matters. Another popular comment from students, to the extent that it became normal for tutors marking their work, was that they did not realize that they were capable of achieving what they produced.

In terms of task there are some possible effects that need to be taken into account. The first is the use of an online design studio where students could upload images and photos of the T-shirts they were working on and including an image of their final design at a point before the official assignment cut-off date. What happens in this online space adds a social dimension to the work; students see the completed work of others and have that available as exemplars for their own work – in terms of method, technique or more generally as inspiration (Jones and Lloyd 2013). This means that some students, unsure of their own creative ability and what to do, draw on the work of others. Such a mechanism could have several potential effects. Overall it may drive up quality, but there is also a possibility of fixation and, on a larger scale, a coalescence to a more restricted norm. It could, of course, have the opposite effect. Students may deliberately position themselves against what they see by, for example, choosing different placements and numbers of transfers for example. If both effects were the case,

they would tend to cancel each other out, but this social aspect to the task should be noted. In relation to the three views of creativity, online activity could be argued in a number of ways. Students might orient themselves to what they perceive as 'gifted' students, reinforcing the aura of individual genius; equally they may draw succour from the sheer numbers and variations they perceive in thinking of themselves as 'normal'.

The results as presented provide a snapshot into a student population that we have argued is more 'normal' than most design student populations. Obviously students self-select to study design; thus, the student population presented here could not be said to be representative of the population as a whole, but we would argue that they better represent the general population than do many other courses in design. The homogeneity of students accepted on to many design courses is revealing of their orientation to the first view of creativity in that they generally look for a type of person, the possible future outliers. We are not arguing that there is anything wrong with this per se; it is just that by conceiving of a more commonplace creativity, one is able to tap a huge potential that exists in larger populations for new and emerging subject areas such as Design Thinking. Creativity is often considered to be something of a black box, a thing that works, but is extremely hard to define. This has led to it being considered magical or mystical but such a view does not entail that it be linked with the individual view of creativity. The view we have put across, and evidenced, is very much of creativity as a black box, but as an engine to produce diversity rather than a gift to produce originality. What is important is to teach good grammar, to establish design processes that are easy to understand, use and develop for a wider public.

## References


Amabile, T. M. (1983), 'The social psychology of creativity: A componential conceptualization', *Journal of Personality and Social Psychology*, 45:2, pp. 357–76.

Casakin, H. P. (2007), 'Factors of metaphors in design problem-solving: Implications for design creativity', *International Journal of Design*, 1:2, pp. 21–33.

Chomsky, N. (2002), *Syntactic Structures*, 2nd ed., Berlin: De Gruyter.

Coyne, R. (1997), 'Creativity as commonplace', *Design Studies*, 18:2, pp. 135–41.

Craft, A. (2006), 'Fostering creativity with wisdom', *Cambridge Journal of Education*, 36:3, pp. 337–50.

Crilly, N., Moultrie, J. and Clarkson, J. P. (2004), 'Seeing things: Consumer response to the visual domain in product design', *Design Studies*, 25:6, pp. 547–77.

Cziksentmihalyi, M. (1998), 'Society, culture and person: A systems view of creativity', in Sternberg, R. J. (ed.), *The Nature of Creativity*, Cambridge: Cambridge University Press, pp. 325–39.

de Bono, E. (1977), *Lateral thinking: A Textbook of Creativity*, London: Penguin.

Dorst, K. and Cross, N. (2001), 'Creativity in the design process: Co-evolution of problem–solution', *Design Studies*, 22:5, pp. 425–37.

Forty, A. (1986), *Objects of Desire: Design and Society Since 1750*, London: Thames and Hudson.

Gladwell, M. (2009), *Outliers: The Story of Success*, London: Penguin.

Hekkert, P., Snelders, D. and van Wieringen, P. C. W. (2003), 'Most advanced, yet acceptable: Typicality and novelty as joint predictors of aesthetic preference in industrial deign', *British Journal of Psychology*, 94:1, pp. 111–24.

Hockney, D. (2006), *Secret Knowledge: Rediscovering the Lost Techniques of the Old Masters*, London: Thames and Hudson.

Hsiao, K. A. and Chen, L. L. (2006), 'Fundamental dimensions of affective responses to product shapes', *International Journal of Industrial Ergonomics*, 36:6, pp. 553–64.

Hung, W. K. and Chen, L. L. (2012), 'Effects of novelty and its dimensions on aesthetic preference in product design', *International Journal of Design*, 6:2, pp. 81–90.

Jones, D. (2014), 'Reading students' minds: Design assessment in distance education', *Journal of Learning Design,* 7:1, pp. 27-39.

Jones, D. and Lloyd, P. (2013), 'Which way is up? Space and place in virtual learning environments for design', in J.-B. Reitan, P. Lloyd, E. Bohemia, L.-M. Nielsen, I. Digranes and E. Lutnæs (eds), *DRS//Cumulus: Design Learning for Tomorrow, Proceedings of the 2nd International Conference for Design Education Researchers*, Oslo: ABM-media, pp. 552–63.

Kaufman, J. C. and Baer, J. (2012), 'Beyond new and appropriate: Who decides what is creative?', *Creativity Research Journal*, 24:1, pp. 83–91.

Lloyd, P. (2013), 'Embedded creativity: Teaching Design Thinking via distance education', *International Journal of Technology and Design Education*, 23:3, pp. 749–65.

Lloyd, P. and Scott, P. (1994), 'Discovering the design problem', *Design Studies*, 15:2, pp. 125–40.

Loewy, R. (1951), *Never Leave Well Enough Alone*, New York, NY: Simon and Schuster.

Mackinnon, D. W. (1962), 'The nature and nurture of creative talent', *American Psychologist*, 17:7, pp. 484–95.

O'Hara, L. A. and Sternberg, R. J. (2001), 'It doesn't hurt to ask: Effects of instructions to be creative, practical, or analytical on essay-writing performance and their interaction with students' thinking styles', *Creativity Research Journal*, 13:2, pp. 197–210.

Osche, R. (1990), *Before the Gates of Excellence: The Determinants of Creative Genius*, Cambridge: Cambridge University Press.

Poincare, H. (1910), 'Mathematical creation', *The Monist*, XX:3, pp. 321–35.

Robinson, A. (2010), *Sudden Genius: The Gradual Path to Creative Breakthroughs*, New York: Oxford University Press.

Ryhammar, L. and Brolin, C. (1999), 'Creativity research: Historical considerations and main lines of development', *Journal of Educational Research*, 43:3, pp. 259–73.

Sellier, A.-L. and Dahl, D. W. (2011). 'Focus! Creative success is enjoyed through restricted choice', *Journal of Marketing Research*, XLVIII:December 2011, pp. 996–1007.

Steiner, G. (2002), *Grammars of Creation*, London: Faber and Faber.

Sternberg, R. J. and Lubart, T. I. (1991), ‘An investment theory of creativity and its development’, *Human Development*, 34:1, pp. 1–31.